Brief Summary

<u>The use of NREL's SAM to approximate the performance of Bifacial PV Installations</u>

Bifacial PV systems have interesting advantage, especially now that rooftop installations need to consider load matching with its host building as net metering fades into history.

1) An east / west installation

The Grid and buildings don't exist in isolation - their interaction is key to a sustainable economy. Recently there has been a rethink of the impact of Net Zero Buildings and their detrimental impact on the performance of the grid at high penetration levels. Of interest then is a particular type of east / west Bifacial PV installation that can reduce the impact of the worrisome Californian "Duck Curve"

2) Installation near Airports

The vertical installation afforded by bifacial PV panels reduces the risk of glint and glare from panels installed near flight paths, near freeways, or in dense urban environments surrounded by buildings

3) Installation on the equator

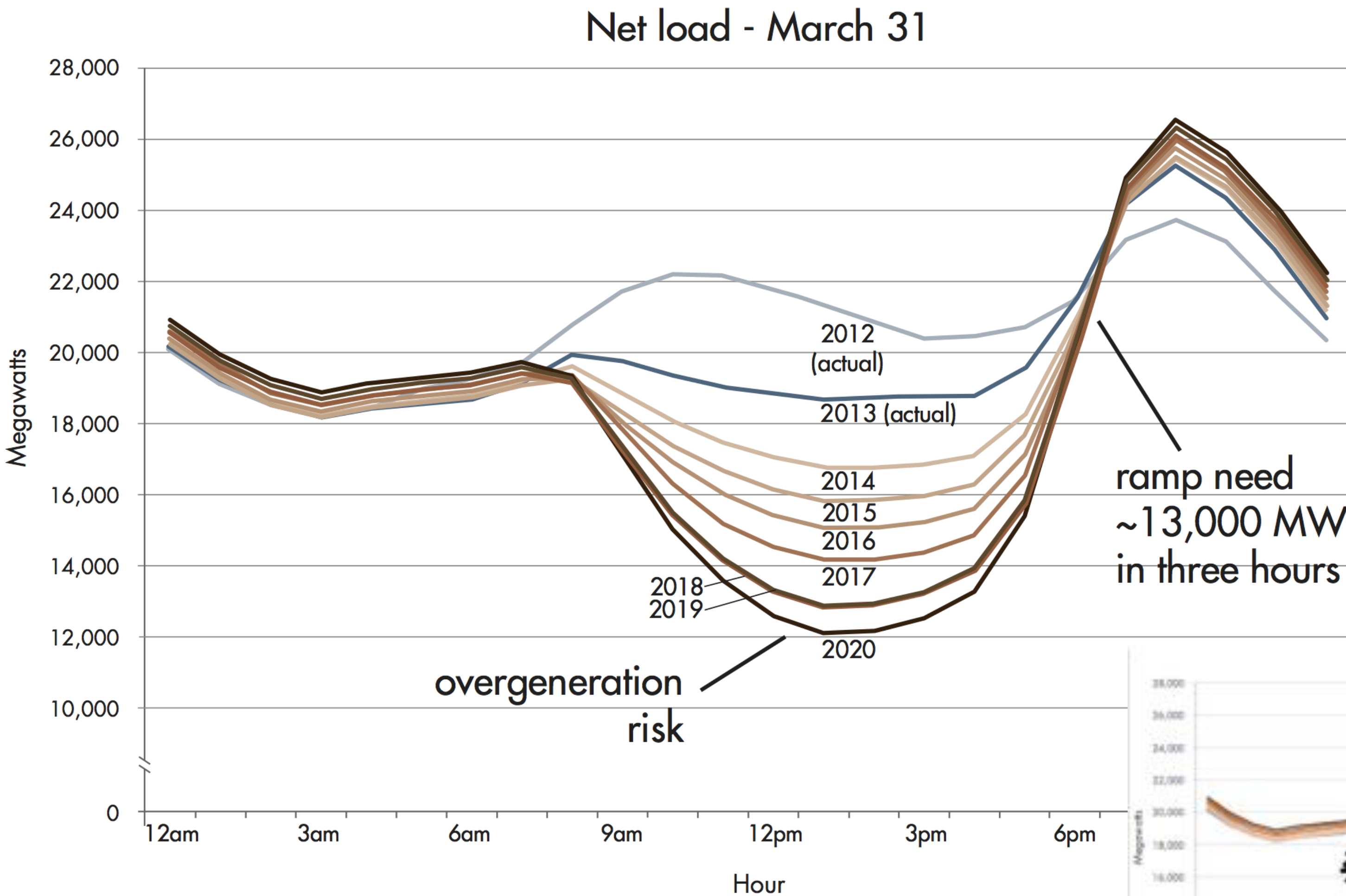
There is much debate as to the preferred orientation and tilt of panels for installations on the equator. Many panels are installed flat, or with an east/west sawtooth arrangement. An east / west bifacial installation shows some advantages including a better spread of power.

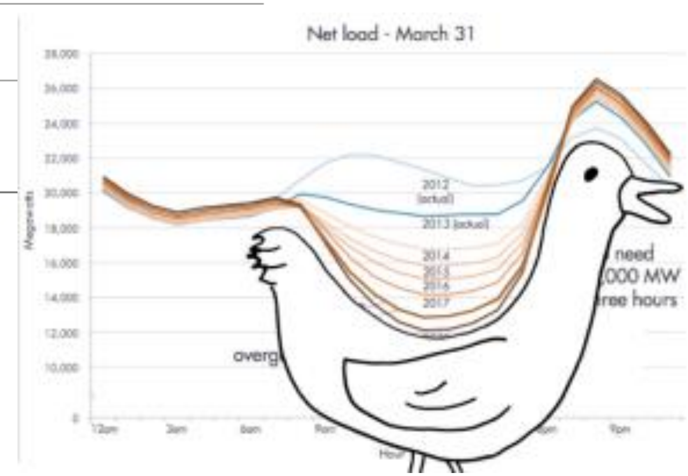
The use of NREL's SAM to approximate the performance of Bifacial PV Installations

Mike Barker
- MIEEE, MASHRAE, MCIBSE, LEED AP, MIBPSA

Johannesburg South Africa
www.BuildingPhysics.co.za

Californian Duck Curve

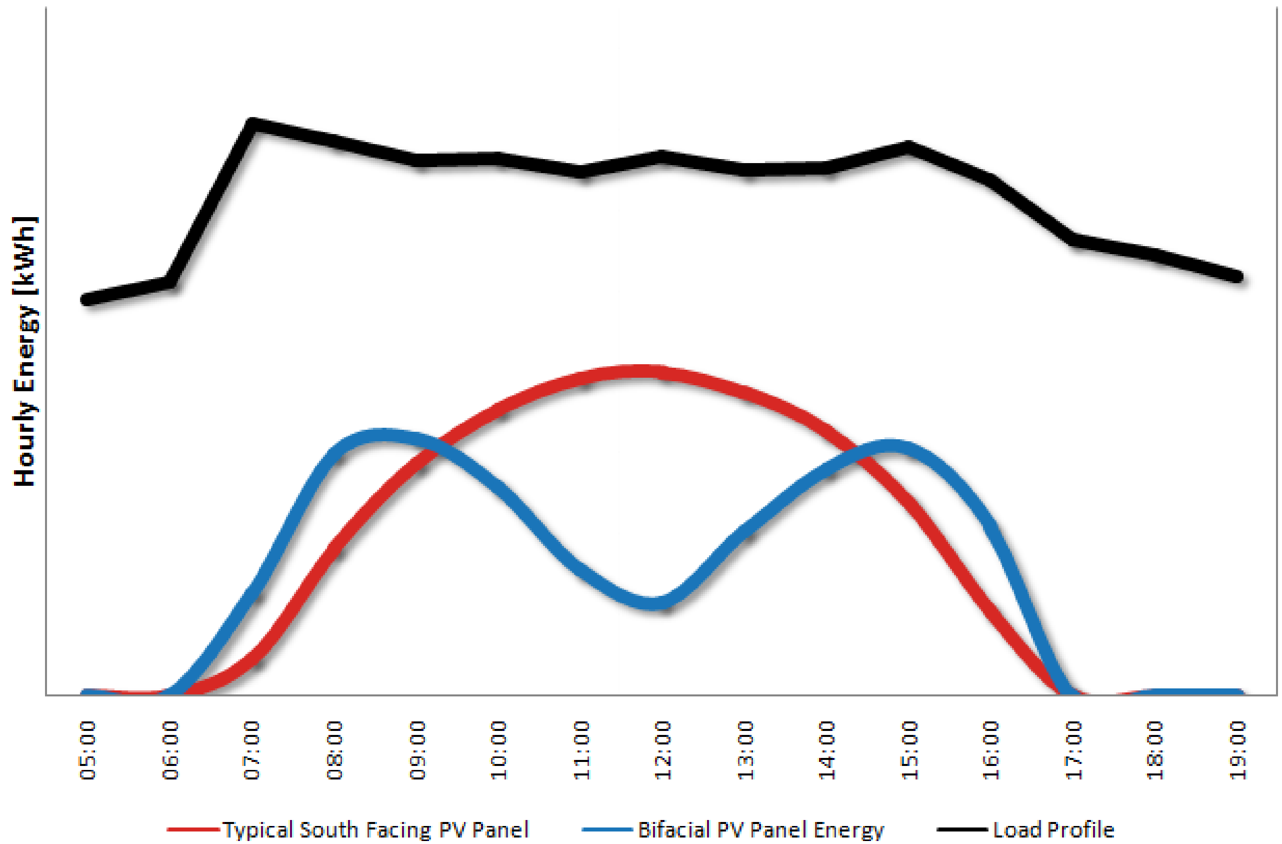


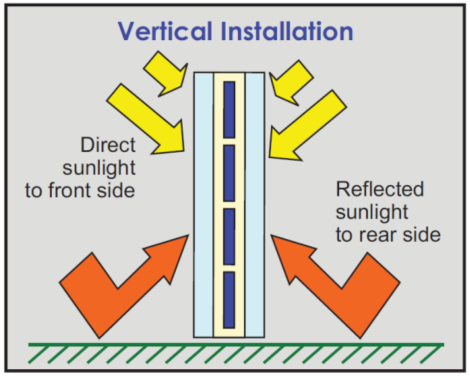


PV load matching can reduce the Californian “Duck Curve”

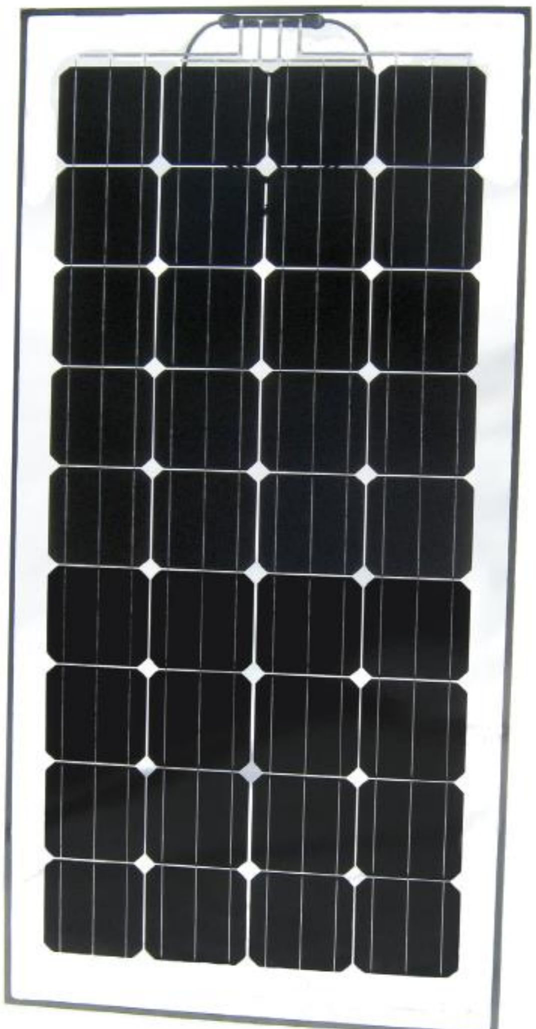
A vertical Bifacial PV installation facing east / west (see graph – blue line) compared to a south facing system of equal size.

The building load (black line) shows a typical commercial building’s twin peaks.





BiFacial Panels - Additional backside irradiation



Bifacial Module

Prism Solar TECHNOLOGIES

Electrical Data

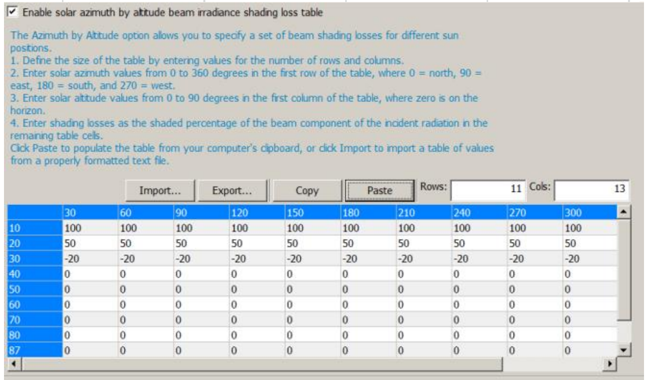
			Projected specifications including additional backside irradiation contribution in Isc as a percent of STC.		
		STC[1]	10%	20%	30%
Rated Power	Pmax (W)	150	165	180	194
Rated Voltage	Vmp (V)	18.3	18.4	18.4	18.4
Rated Current	Imp (A)	8.2	8.96	9.77	10.6

Adjusting the Beam Shading Losses

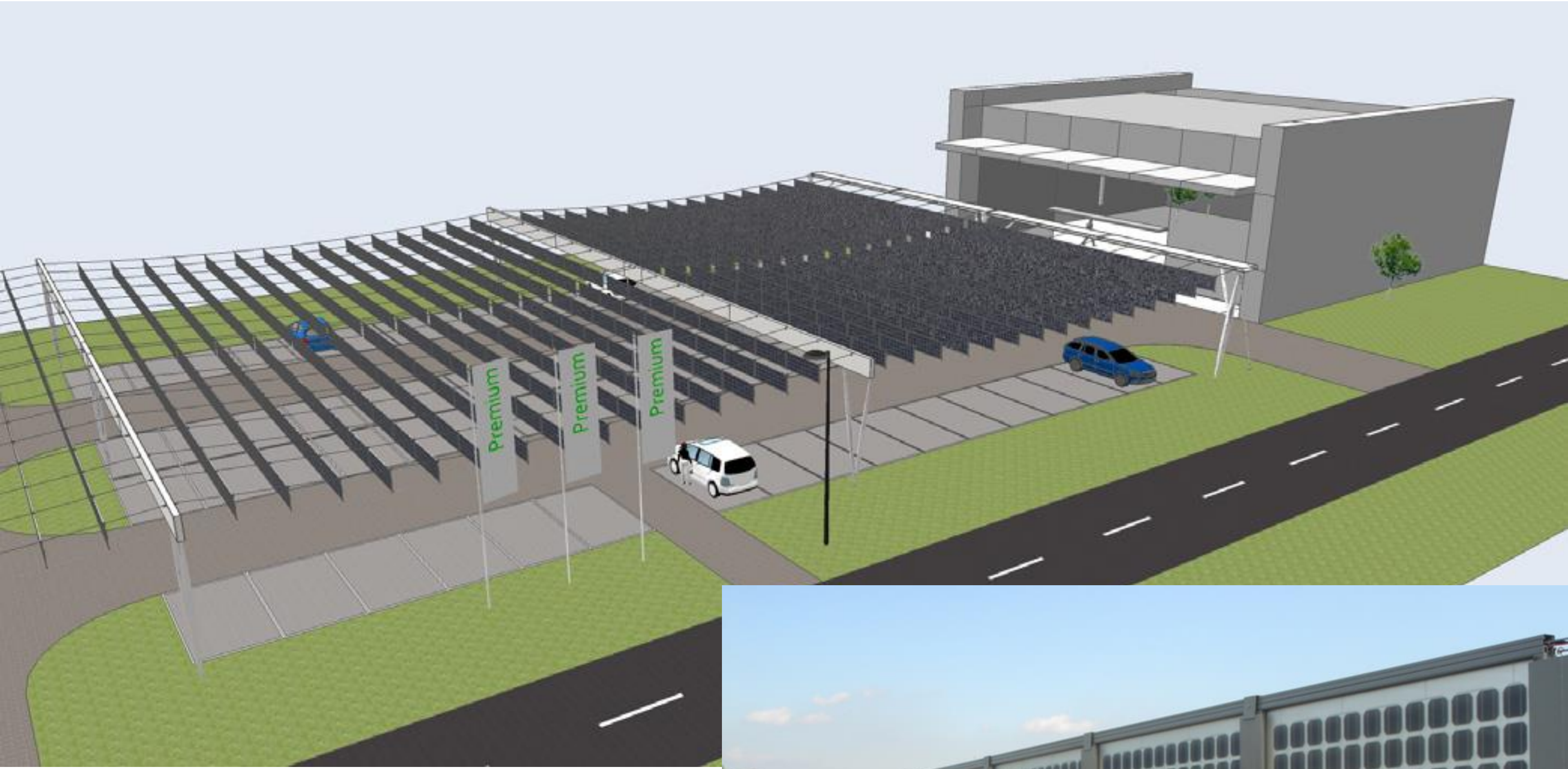
0	30	60	90	120	150	180	210	240	270	300	330	360
10	100	100	100	100	100	100	100	100	100	100	100	100
20	50	50	50	50	50	50	50	50	50	50	50	50
30	-20	-20	-20	-20	-20	-20	-20	-20	-20	-20	-20	-20
40	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	[illegible]	[illegible]	[illegible]	0	0	0	0	0
60	0	0	0	0	[illegible]	[illegible]	[illegible]	0	0	0	0	0
70	0	0	0	0	[illegible]	[illegible]	[illegible]	0	0	0	0	0
80	0	0	0	0	[illegible]	[illegible]	[illegible]	0	0	0	0	0
87	0	0	0	0	0	0	0	0	0	0	0	0
90	100	100	100	100	100	100	100	100	100	100	100	100

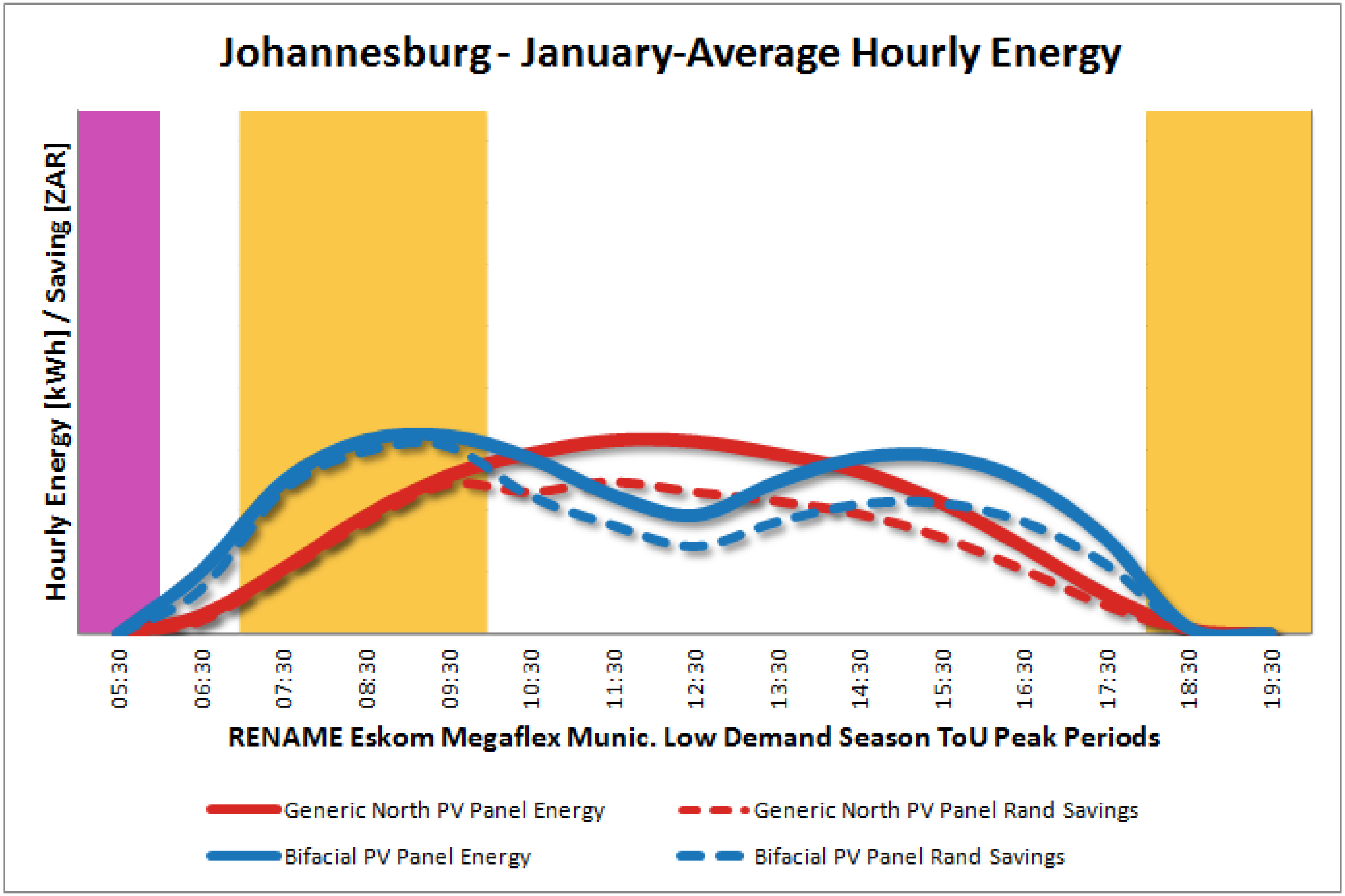
-ve shading loss to model extra reflected energy ? (Albedo)

One possible approach that SAM may want to allow is the ability to introduce extra reflected energy by adjusting the shading losses



	30	60	90	120	150	180	210	240	270	300
10	100	100	100	100	100	100	100	100	100	100
20	50	50	50	50	50	50	50	50	50	50
30	-20	-20	-20	-20	-20	-20	-20	-20	-20	-20
40	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	0
87	0	0	0	0	0	0	0	0	0	0


Premium
Premium
Premium



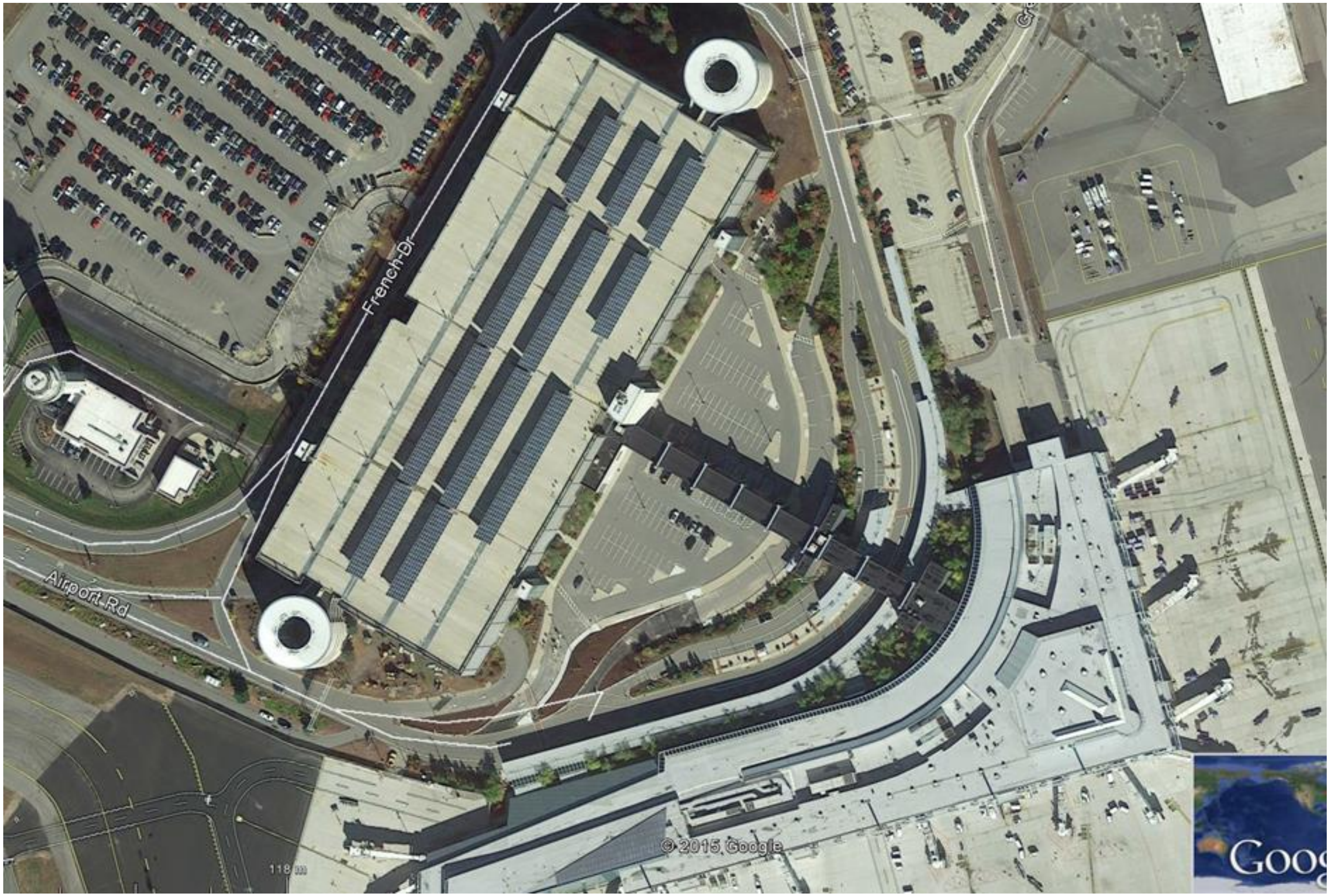
Average Day Totals

Total Generic North PV Panel Energy for an Average Day in January	4984 kWh
Total Bifacial PV Panel Energy for an Average Day in January	5843 kWh
Total Generic North PV Panel Rand Value of Energy for an Average Day in January	3993 ZAR
Total Bifacial PV Panel Rand Value of Energy for an Average Day in January	4750 ZAR

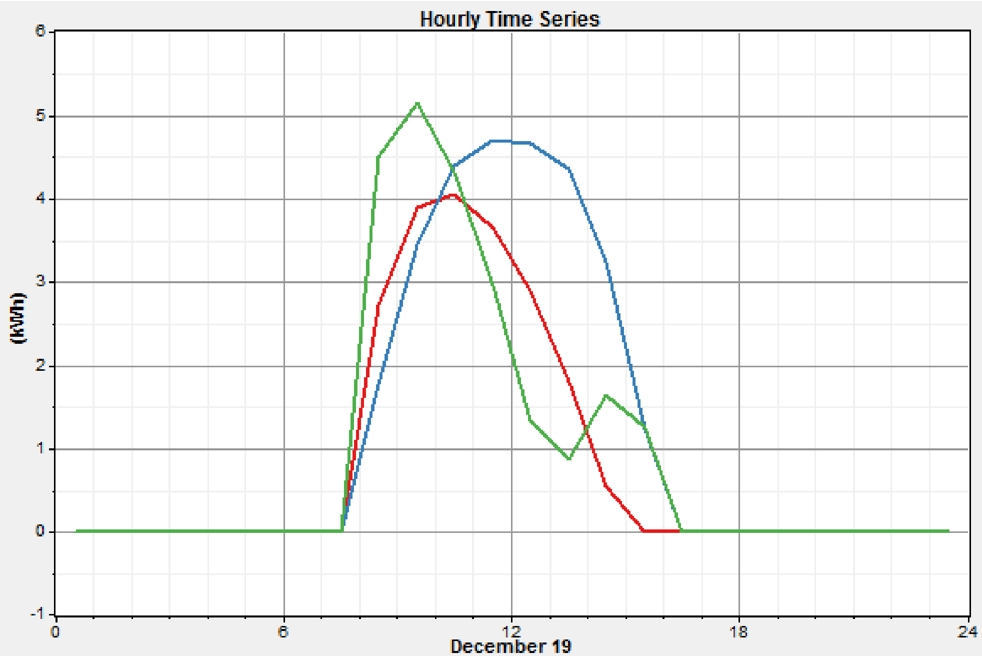
Manchester-Boston Regional Airport

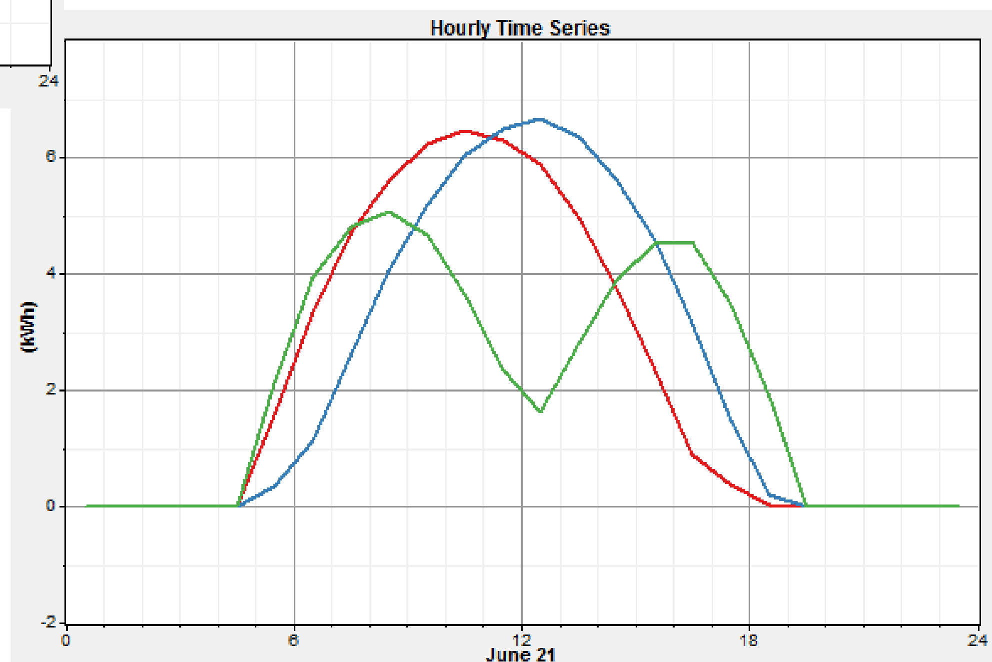
Manchester·Boston
REGIONAL AIRPORT

BUILDING PHYSICS


French Dr
Airport Rd
© 2015 Google
118 m
Goog

Manchester-Boston, USA





Total Annual Energy (kWhr)

- **Before 11 428**
- **After 10 326**
- **BiFacial 9 652**

Nairobi, Kenya

- Equatorial location

Total Annual Energy (kWhr)

Vertical BiFacial 12 063

Horizontal 10 440